Available online at www.sciencedirect.com
ScienceDirect
Expert Systems with Applications 36 (2009) 209–218
Expert Systems with Applications
www.elsevier.com/locate/eswa

Designing a knowledge-based system for strategic planning: A balanced scorecard perspective

Hao-Chen Huang *

Graduate Institute of Business Administration, National Taiwan University, College of Management Floor 9, No. 1, Sec. 4, Roosevelt Road, Taipei, 106, Taiwan, ROC

Abstract

First developed by Kaplan and Norton [Kaplan R. S., & Norton D. P. (1992). The balance scorecard – measures that drive performance. *Harvard Business Review*, 70(1), 71–79], balanced scorecard (BSC) provides an integrated view of overall organizational performance and strategic objectives. BSC integrates financial measures with other key performance indicators to create a perspective that incorporates both financial and non-financial aspects. BSC has proven a powerful tool for strategic planning and communicating strategy that assists in strategy implementation. Successful strategy implementation is based on effective strategic planning. Owing to the strategic planning being a virtual necessity in business, this work proposes an integrated approach for the balanced scorecard tool and knowledge-based system using the analytic hierarchy process (AHP) method, and then develops an intellectual BSC knowledge-based system for strategic planning that sets or selects firm management or operational strategies based on the following perspectives: learning and growth, internal/business process, customer, and financial performance. This system can help determine specific strategy weights. The intellectual BSC knowledge-based system facilities efficient automated strategic planning.

Keywords: Knowledge-based system; Balanced scorecard; Analytic hierarchy process

1. Introduction

Academicians and researchers involved in strategic management and managerial accounting have devoted increasing attention in the recent decade to the influence of balanced scorecard (BSC) on organizational performance and strategic planning. The BSC designed by Kaplan and Norton (1992) uses a sequence of four perspectives that reflects firm value creation activities. The sequence is as follows: learning and growth perspective, internal/business process perspective, customer perspective, and finally financial perspective. Core outcome (performance) measures within each perspective are adopted as leading indicators of the core outcome measures in the next perspective. Since, its initial development by Kaplan and Norton, BSC has been widely adopted by manufacturing and service companies, nonprofit organizations, government entities, and other industries around the world. Firms are increasingly implementing new performance measurement systems to track non-financial metrics, with related research including Andrews (1996), Banker, Chang, and Pizzini (2004), Banker, Potter, and Srinivasan (2000), Frigo (2002), Said, HassabElnaby, and Wier (2003).

Since its introduction in the early 1990s, the BSC has evolved from a performance measurement tool to a strategic management tool. The BSC methodology creates an infrastructure for strategic management activities. The scorecard introduces four new management processes that, separately and in combination, contribute to linking long-term strategic objectives and short-term actions (Kaplan & Norton, 1996a). By combining the financial, customer, internal process, and learning/growth perspectives, BSC helps managers understand numerous interrelationships and causal effects.

* Tel.: +886 2 33661058; fax: +886 2 23625379.
E-mail address: d94741004@ntu.edu.tw

0957-4174/$ - see front matter © 2007 Elsevier Ltd. All rights reserved.
doi:10.1016/j.eswa.2007.09.046

This understanding can help managers transcend traditional notions regarding functional barriers and ultimately improve decision-making and problem solving. Strategy and execution reviews can help management teams review the strategic plans, the planning process, including BSC metrics and strategy maps (Frigo, 2002, 2004).

Strategic planning is virtually essential in business. A strategic plan differs from an operational plan. A strategic plan should be conceptual, visionary and directional. Owing to the complexity and importance of strategic planning, the knowledge-based system (KBS) is frequently used to support decision-making. Knowledge-based systems (KBS) are computer-based tools that facilitate managerial decision-making by presenting various effective alternatives. By the 1990s, intelligent knowledge-based systems came to play an important role in new decision support tools. But few studies involving KBS with BSC strategic management or planning have been done (Berler, Pavlopoulos, & Koutsouris, 2005; Martinsons, Davison, & Tse, 1999; Sohn, You, Lee, & Lee, 2003; Sundararajan, Srinivasan, Staehle, & Zimmers, 1998). This study thus provided an intelligent knowledge-based system for strategic planning that sets or selects firm strategy based on the BSC perspectives. This KBS can be used as a strategic planning tool planning or setting strategy based decision-making information. KBS is designed to offer a conclusive reference for helping decision makers make correct decisions in the face of complex situations and large quantities of information. Intelligent BSC knowledge-based system (BSCKBS) is designed to develop a strategic planning system for implementing business systems to support needs. Consequently, KBS adopts a user-oriented interface, and establishes management strategies based on assessment of the business vision and strategy.

Based on the above concern, this work has two related aims: (a) to propose an integrated framework for the balanced scorecard tool and knowledge-based system using the analytic hierarchy process (AHP) method; and (b) to develop an intellectual BSC knowledge-based system for strategic planning that sets or selects firm's strategy from the following perspectives: learning and growth, internal/business process, customer, and financial performance. Using the AHP method for the analysis, this work examines how management can select objectives and measures using the BSC hierarchy. This work addressed two key topics: setting objectives and the selection of appropriate measures. Firm executives are well aware that rapid implementation of change is difficult. However, strategic planning is important for strategy execution. Consequently, this work describes the use of AHP to prioritize all of the measures and strategies in a BSC framework and tries to establish an intelligent BSC strategic planning and management decision support system for strategic planning, that is, the BSC knowledge-based system (BSCKBS).

The remainder of this paper is organized as follows. Section 2 briefly reviews the knowledge-based system (KBS) and related applications. Section 3 briefly reviews the BSC view and related research. Section 4 then describes the AHP theorem and related research. Next, Section 5 describes the architecture of the BSC knowledge-based system and related content. Finally, concluding remarks and a summary are presented in Section 6.

2. Knowledge-based system and applications

2.1. The concept of knowledge-based system (KBS)

The computer user high-tech dictionary defines a knowledge-based system (KBS) as a computer system designed to imitate human problem solving via a combination of artificial intelligence and a database of subject specific knowledge. Knowledge-based systems are based on artificial intelligence (AI) methods and techniques. The core components of knowledge-based systems are knowledge-base and inference/reasoning mechanisms. KBS, like problem processing systems, function to retrieve information from a knowledge system and to use this information to obtain useful results and for decision-making. KBS are computer systems that represent knowledge in the form of heuristics for problem solving to assist humans in decision-making (Clark & Soliman, 1999). In practice, KBS is a frequent abbreviation for knowledge-based systems.

In the literature on KBS, Dhaliwal and Benbasat (1996) proposed that the four main components of KBS are generally as follows: knowledge-base, inference engine, knowledge engineering tool, and specific user interface. Chau and Albermani (2002) proposed that KBS comprise three basic components: knowledge-base, context and inference mechanism. The knowledge-base thus is the heart or core component of the KBS and contains domain expert knowledge stored via various representation techniques (such as semantic networks, frames and logic) (Curtis & Cobham, 2002); the most widely used technique or method is the "if (condition) then (action)" production rule.

2.2. The applications of knowledge-based system (KBS)

During the 1990s, academics and researchers began to recognize the importance of KBS and its related concepts became one of the most popular topics related to decision support tools or management information systems (MIS). Since its development KBS has been widely applied to various studies and issues, including performance assessment (Ammar, Duncombe, Jump, & Wright, 2004; Wang, 2005; Wang, Huang, & Lai, 2007), commercial loan underwriting (Kumra, Stein, & Assersohn, 2006), logistics strategy design (Chow, Choy, Lee, & Chan, 2005), farm productivity (Pomar & Pomar, 2005), mergers and acquisitions (Wen, Wang, & Wang, 2005a, 2005b), defense budget planning (Wen et al., 2005a, 2005b), earthquake design (Berrais, 2005), system dynamics (Yim, Kim, Kim, & Kwahk, 2004), conveyor equipment selection (Fonseca, Uppal, & Greene, 2004), customer service management (Cheung, Lee, Wang, Chu, & To, 2003) and knowledge inertia (Liao, 2002).